

Council on Postsecondary Education

Annual Report

House Bill 572 Knowledge-based Economy Programs

Table of Contents

I.	Executive Summary	1
II.	Glossary	5
III.	Introduction and History	13
IV.	Commercialization Investment Programs	14
	A. R&D Voucher Program	
	B. Rural Innovation Program Level 1 and Level 2	
	C. Commercialization Program	
	D. Total CIP Awards by Research Priority Area	
V.	Kentucky Science and Engineering Foundation.....	28
	A. R&D Excellence Research Categories	
	B. Selection Process	
	C. Recommendation and Approval Process	
VI.	Experimental Program to Stimulate Competitive Research	35
	A. Allocations of State Match Funds, July 1, 2001 to June 30, 2002	
	B. Kentucky EPSCoR Matching Grants, July 1, 2001 to June 30, 2002	
VII.	Entrepreneurial Audit.....	40
VIII.	Related Initiatives to Kentucky Knowledge-based Economy	41
	A. Endowment Match Program	
	B. R&D Goals	
	C. Office for the New Economy Strategic Plan	
	D. Innovation and Commercialization Centers	
	E. Role Model Program	
IX.	Selected Success Stories	44
X.	Benefits for Kentucky Citizens	46
XI.	Findings and Recommendations	48

Table of Tables

Table 1.	Knowledge-based Economy Program Summary, 2001-02.....	3
Table 2.	KSTC Commercialization Investment Programs FY July 1, 2001 to June 30, 2002	14
Table 3.	Nine R&D Voucher projects funded in 2001-02, total \$899,667	17
Table 4.	Nine Rural Level 1 awards granted in 2001-02, total \$66,500	20
Table 5.	Four Rural Level 2 awards granted in 2001-02, total \$99,200	22
Table 6.	Seven Commercialization projects funded in 2001-02, total \$477,593	25
	Total CIP Awards, by Research Priority Area, 2001-02	26
Table 7.	Kentucky Science and Engineering Foundation, 2001-02.....	28
Table 8.	Distribution of KSEF awards in 2001-02	32
Table 9.	Kentucky Experimental Program to Stimulate Competitive Research , 2001-02	35
Table 10.	Kentucky EPSCoR allocations of state matching funds, FY 2001-02.....	39
Table 11.	Kentucky EPSCoR matching grants to public and private institutions, FY 2001-02	39

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House Bill 572 Knowledge-based Economy Programs

I. Executive Summary

HB 525, 2002 Regular Session, calls for the Council on Postsecondary Education to submit an annual report to the Kentucky Innovation Commission, the Governor, and the General Assembly. The report is to detail the Council's work related to the Science and Technology Programs created in KRS 164.6021 (R&D Voucher Program), 164.5029 (Commercialization Program), and 164.6037 (Rural Innovation Program). The report is to include progress made in achieving each program's purposes, qualitative and quantitative information concerning the applications received, projects approved and undertaken, companies served, funding amounts invested in each project or program, and findings and recommendations to increase each program's effectiveness in achieving its purposes. For this initial report, findings and recommendations are focused on the generic initiative, not individual programs. Future reports will address issues associated with individual programs.

The Kentucky Innovation Act, HB 572, 2000 Regular Session, created a knowledge-based economy blueprint for Kentucky, with programs housed in the Cabinet for Economic Development, the Council on Postsecondary Education, and the Kentucky Science and Technology Corporation. The legislation created research and development support programs, provided manufacturing modernization services, and provided the necessary fiscal stimulus to create, attract, incubate, and grow high-tech and biotech firms.

The following are descriptions of knowledge-based economy programs for which the council has responsibility and other related initiatives currently underway.

- The R&D Voucher program is a \$3 million investment fund that enables small and medium-sized Kentucky-based firms to undertake research and development working partnerships with Kentucky university researchers. Investments are made in technology refinement, prototype development, and commercial product development.
- The Rural Innovation program is a \$1 million investment fund, and assists small, rural, Kentucky-based firms to undertake research and development. Funds must be used in partnership with a university or an appropriate third party. Investments are made in proof of concept development and early stage prototyping.

- The Commercialization fund has \$750,000 to invest in university faculty who want to translate their research into marketable products.
- The Kentucky Science and Engineering Foundation builds R&D excellence in the commonwealth, particularly in Kentucky's priority research focus areas: human health and development, biosciences, information technology and communications, environmental and energy technology, and materials science and advanced manufacturing.
- The Experimental Program to Stimulate Competitive Research was created in 1978 in response to congressional concern over the inability of some states to compete for federal research and development grants and contracts. Kentucky began participating in the program in 1986 and since that time scientists and engineers at the commonwealth's universities have received awards from all major federal agencies with EPSCoR programs: Department of Energy, Department of Defense, Environmental Protection Agency, NASA, National Institutes of Health, National Science Foundation, and the Department of Agriculture.
- The Endowment Match Program, or "Bucks for Brains," operationalized through the Research Challenge Trust Fund and the Regional University Excellence Trust Fund, combines public monies and private donations to support research at UK and UofL, and to strengthen key programs at the comprehensive universities.

Through June 30, 2002, "Bucks for Brains" has increased the number of endowed chairs from 55 to 166 and endowed professorships from 55 to 228 statewide. This program also has helped the universities in their efforts to compete for federal research funds. In addition, Bucks for Brains faculty have a measurable and significant positive economic impact on their communities.

- The Commissioner for the New Economy developed a statewide strategic plan for the knowledge-based economy. The plan recognizes Kentucky's current position in the knowledge-based economy and identifies niches where Kentucky might gain a competitive edge within a decade.
- An Innovation and Commercialization Center program was implemented in 2001. The ICCs are public/private partnerships that assist the commonwealth's entrepreneurs and scientists to commercialize technologies that demonstrate significant market potential.

Six ICCs will bring together individuals from the business sector, universities, Kentucky Community and Technical College System, local communities, and state government to create and expand knowledge-based companies. Fourteen satellite centers are affiliated with the ICCs and will serve the needs of rural areas. They will be housed in KCTCS for administrative support.

- The Role Model Program is a partnership among UK, UofL, Eastern Kentucky University, Kentucky State University, Morehead State University, Murray State University, Northern Kentucky University, Western Kentucky University, the Governor's Office, and the Office for the New Economy. It uses university coaches and players to introduce scientists, engineers, and entrepreneurs to the public. Students learn what the scientists, engineers, and entrepreneurs do, and exposure to these professionals is expected to prompt students to broaden their perspectives and direct their aspirations to scientific and business endeavors.

Table 1. Knowledge-based Economy Program Summary, 2001-02

	<i>2001 Brought Forward</i>	<i>2002 Appro- priation</i>	<i>2002 Budget Cuts</i>	<i>Revised Appro- priation</i>	<i># of Awards</i>	<i>Amount Awarded</i>	<i>Admin Costs</i>	<i>Carry Forward</i>
R&D Voucher	0	3,000,000	35,100	2,964,900	9	899,867	96,854	1,968,379
Rural Innovation	861,500	0	0	861,500	13	165,700	96,853	598,947
Commercial- ization	0	750,000	8,750	741,250	7	477,593	96,853	166,804
Regional Tech Corp	0	500,000	5,850	494,150	0	0	96,853	397,297
	861,500	4,250,000	49,700	5,061,800	29	1,542,960	387,413	3,131,427
						**		
KSEF	2,000,000	0,	0	2,000,000	32	1,568,000	432,000	0
EPSCOR	0	2,626,200	104,600	2,521,600	14	2,342,600	175,000	***
	2,861,500	6,876,200	154,300	9,583,400	75	5,453,560	994,413	3,135,427

* - \$2,693,927 of the carry forward will be transferred to the Office of the New Economy

** - Does not include \$388,692 from 2000-01 appropriations

*** - Lapsed

Findings

- While knowledge-based economic issues were not part of the council's role defined in HB 1, they have become critical to the council's role in postsecondary education and research.
- The entrepreneurial audit's findings have resulted in a diverse constituency coming together to plan and implement a successful economic strategy for Kentucky.
- All knowledge-based economy programs are new, except for EPSCoR, and have only one year of data on which to measure success. Approximately 43% of the initial programs' appropriations remain to be disbursed because time was taken to set up sound program administration infrastructure, to request and thoroughly assess applications, and to disburse and manage the grants. Rigorous application and external review processes are critical to fund projects that meet high scientific

and commercial standards and to develop successful research and economic initiatives for Kentuckians.

- R&D and commercialization are long-term endeavors which will require new investment funds, a deep pool of knowledgeable workers, and an entrepreneurial climate.
- New issues, such matters as intellectual property rights and public policy implications of some kinds of research, will emerge as the knowledge-based economy programs are implemented and future amendments to the Kentucky Innovation Act of 2000 will be necessary.

Recommendations

- Secure third-round funding for the Endowment Match Program and maintain the existing funding for the Commercialization Investment Programs, Innovation and Commercialization Centers, and Office for the New Economy programs [see Glossary].
- Formally establish the Knowledge-based Economy Advisory Workgroup and charge it to meet regularly to continue to guide implementation of legislation. Members should continue to include representatives from the council, the Office of the New Economy, the Cabinet for Economic Development, the Governor's Office for Policy and Management, the Legislative Research Commission, the Governor's Office on Agriculture Policy, the Finance and Administration Cabinet, EPSCoR, the Kentucky Science and Technology Corporation, and the Labor Cabinet.
- Adopt a long-term plan to "graduate" Kentucky from the federal EPSCoR program.
- Determine whether EPSCoR and the Kentucky Science and Engineering Foundation would be better served and more efficient at capturing increased federal funding if their administrations were integrated and more closely aligned.

II. Glossary

Commercialization Investment Programs

CIP, Commercialization Investment Programs, provides funding for the Research and Development Program, Rural Innovation Program, and Commercialization Fund, all established in the Kentucky Innovation Act, HB 572, 2000 Regular Session.

EPSCoR, the Experimental Program to Stimulate Competitive Research

EPSCoR, the Experimental Program to Stimulate Competitive Research was initiated by the National Science Foundation (NSF) in 1979 as a unique infrastructure-building effort to encourage local action to develop long term improvements in a state's science and engineering enterprise. It was created in response to Congressional concerns about geographical concentration of Federal funding of academic research and development.

Nineteen states and Puerto Rico have been designated as EPSCoR states. Through these federal-state partnerships, EPSCoR focuses on science, engineering, and technology capabilities that promote national competitiveness. These partnerships help to balance the distribution of federal research dollars and use state or local control in the delivery of program goals.

The success of NSF EPSCoR in the 1980s led Congress to expand the NSF program in the 1990s and create EPSCoR-related programs in the Department of Energy (DOE), Department of Defense (DoD), Department of Agriculture (USDA), Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), and the National Institutes of Health (NIH).

All agencies have research competitiveness as a cornerstone upon which the states are to develop strategies leading to future national prominence. Each EPSCoR state designs and executes its own strategic plans by melding exemplary research, education, and economic development initiatives into a statewide approach. EPSCoR is a catalyst of change that is widely viewed as a model federal-state partnership.

The Kentucky Statewide EPSCoR Committee operates a quasi-independent committee of the Kentucky Science and Technology Corporation. Its purpose is to stimulate and enhance competitive research, to stimulate and effect systemic and sustainable improvement in the capacities of the state's universities and colleges to compete successfully for research and development funds on a national basis, and to stimulate complementary cooperative efforts in education and human research development to ensure growth and support of science, engineering, and mathematics research and training.

Dr. Wimberly Royster is Kentucky's EPSCoR Chair. The Statewide Committee is composed of nineteen members with statewide representation. Members include six university administrators, seven faculty researchers, and six private/public

representatives. The university administrators must have experience in basic science and engineering supported by federal agency EPSCoR programs. The faculty members must have well-established records of external funding in basic science and engineering supported by federal agency EPSCoR programs. The private/public sector representatives must have backgrounds in science and/or engineering. All members of the Statewide EPSCoR Committee are expected to have an understanding of current science policy and related areas.

Members of the Statewide EPSCoR Committee are:

Ms. Judi Streepey, Vice Chair;
Mr. Richard Alloo, General Manager, Toyota Motor Manufacturing North American, Inc.;
Dr. Jim Boling, VP for Research, University of Kentucky;
Dr. Del Collins, Associate Vice President for Research, University of Kentucky;
Dr. David Cohn, Department of Biological & Biophysical Sciences, School of Dentistry, University of Louisville;
Dr. Blaine Ferrell, Dean, Ogden College of Science, Health & Technology, Western Kentucky University;
Dr. Eric Grulke, Advanced Carbon Materials Center, University of Kentucky;
Dr. Rick Kurzynske, Lexington, Kentucky;
Dr. T.S. Kochhar, Department of Biology, Kentucky State University;
Dr. John Mateja, Director, Undergraduate Research and Scholarly Activities, Murray State University;
Dr. Nancy Martin, Vice President of Research, University of Louisville;
Dr. Rogers Redding, Vice President for Academic Affairs and Provost, Northern Kentucky University;
Dr. Bob Stout, Chairman, Dept of Microbiology, University of Louisville;
Mr. Ken Tuggle, Frost, Brown, Todd LLC, Louisville, Kentucky;
Dr. David White, Center for Reservoir Research, Murray State University; and
Dr. Marta Cecilia Yappert, Department of Chemistry, University of Louisville.

EPSCoR Subcommittee Chairs are:

Dr. Richard Hackney, Chair, NASA EPSCoR Program, Department of Physics & Astronomy, Western Kentucky University;
Dr. Darrell Chenoweth, Chair, DoD EPSCoR Program, Department of Electrical Engineering, University of Louisville;
Dr. John Connolly, Chair, NSF EPSCoR, University of Kentucky; and
Dr. John Stencil, Chair, DOE EPSCoR Center for Applied Energy Research, Lexington, Kentucky.

House Bill 525, 2002 Regular Session

House Bill 525, 2002 Regular Session, amended HB 572 to create more meaningful tax incentives for knowledge-based business development. HB 525, 2002 Regular Session,

also charged the organization of certain programs created by HB 572 (for example Regional Technology Corps.)

House Bill 572, the Kentucky Innovation Act, 2000 Regular Session

House Bill 572, the Kentucky Innovation Act, 2000 Regular Session, launched Kentucky's knowledge-based economy initiatives. The Act was based on concepts developed by the Kentucky Science and Technology Corporation at the request of Governor Paul Patton, and published in Kentucky's Science and Technology Strategy in 1999. Knowledge-based programs are housed in the Cabinet for Economic Development, the council, and the Kentucky Science and Technology Corporation.

The legislation outlined a vision of a strong, entrepreneurial economy in Kentucky, characterized by knowledge, innovation, and speed. Provisions were geared to support economic development in both urban and rural areas of Kentucky, create research and development support programs, provide manufacturing modernization services, and provide the necessary fiscal stimulus to create, attract, incubate, and grow high-tech firms.

ICC, Innovation & Commercialization Centers

ICC, Innovation & Commercialization Centers are funded by the Cabinet for Economic Development's Office of the New Economy and managed by the Kentucky Science and Technology Corporation. The ICC network is composed of six offices throughout the state with the mandate to increase high quality technology deal flow.

The ICC network will help scientists and entrepreneurs define and perfect their ideas and fund or license new and innovative technologies. The process is built around a well-defined standard that articulates the parameters and requirements of the business concept, valuation of the company, and presentation of the idea to potential investors. The ICC will work through its six regional offices to coordinate local efforts to aggregate investors, service providers, and resources so that ideas and capital can make connections throughout the Commonwealth.

Jim Clifton is Executive Director of the ICCs.

KBE Workgroup, the Knowledge-based Economy Advisory Workgroup

KBE Workgroup, a Knowledge-based Economy Advisory Workgroup was formed in 1999 to draft HB 572 and has continued to meet regularly. Members in KBE Workgroup represent the council, the Office for the New Economy, the Cabinet for Economic Development, the Governor's Office for Policy and Management, the Legislative Research Commission, the Finance and Administration Cabinet, the Governor's Office on Agriculture Policy, the Kentucky Science and Technology Corporation, and EPSCoR. The Workgroup facilitates implementation of the Act, resolves issues not anticipated when the legislation was drafted, maintains communication between cabinets and

agencies as programs come on line, and identified the amendments ultimately adopted in HB 525.

KIC, the Kentucky Innovation Commission

KIC, Kentucky Innovation Commission, was established in HB 572, 2000 Regular Session. Under the legislation that created the commission, membership consists of the Governor, the secretary of the Governor's Executive Cabinet, the secretary of the Cabinet for Economic Development, the president of the council, the state budget director, the Speaker of the House, the President of the Senate, and eight at-large members appointed by the Governor. Four of the appointed members are from the private sector and possess extensive experience and expertise in managing high-technology business or are engaged in an innovation-driven, knowledge-based enterprise, one member is engaged in the business of venture capital, one member represents the private sector and possesses extensive experience and expertise in providing or supporting communications infrastructure, and two members either are engineers or scientists recognized for their scientific or technological research efforts, or educators with an interest or background in teaching students to become highly skilled workers or entrepreneurs.

The current at-large members are:

- Engineer/scientist or educator teaching highly skilled workers:
Dr. Nancy Martin (Louisville), Vice President for Research, Full Professor, and holder of the Preston Pope Joyes Endowed Chair in Biochemical Research, University of Louisville; and
Dr. Ken Roberts (Lexington), Dean, University of Kentucky College of Pharmacy;
- Experience in venture capital:
Craig Greenberg (Louisville), Of Counsel, Frost Brown Todd LLC;
- Experience and expertise relating to providing and supporting communications infrastructure:
E.C. (Eddy) Roberts, Jr. (Louisville), State President, Bell South Kentucky;
- High-tech experience:
Henry Jackson, President, Screw Machine Technologies, Inc., Georgetown, Kentucky;
Dean Hughes, Project Engineer, Community Telephone, Inc., Paducah, Kentucky;
Charleen Combs, co-founder and President, Data Futures, Inc., Harlan, Kentucky; and
Rich Hempel, President and CEO, A.F. Kelly, Covington, Kentucky.

KSEF, the Kentucky Science and Engineering Foundation

KSEF, the Science and Engineering Foundation was created in HB 572, 2000 Regular Session, to build science and engineering capacity and excellence by investing in exploratory advanced research, purpose-driven research, and research in emerging technologies and ideas, human resource development, and technological innovations in Kentucky. KSEF structure and goals have been modeled after the National Science Foundation.

HB 572 directed the Kentucky Science and Technology Corporation to create and manage the Kentucky Science and Engineering Foundation as a means to increase Kentucky's capacity to become a leader state in competitive research by making its own investments in peer-reviewed science and engineering research and by attracting more research funding from all sources to the Commonwealth.

The Kentucky Science and Technology Corporation operates the Foundation through a contract with the council.

Dr. Mahendra Jain is Executive Director of the Foundation.

The KSEF Advisory Board members are:

- the University of Kentucky (Dr. Jim Boling) and UofL (Dr. Nancy Martin) Research Vice Presidents,
- two EPSCoR members from the comprehensive universities (Dr. Blaine Ferrell, Western Kentucky University, and Dr. Tejinder Kochhar, Kentucky State University),
- one member from the independent colleges or universities (Dr. James Miller, Transylvania),
- three corporate representative (Roger Dingus, UPS, Ed McInerney, General Electric, John Zbrozek, Lexmark International),
- and three members with science and engineering connections outside Kentucky (Dr. Charles Kupchella, University of North Dakota, Dr. Charles Wyman, Dartmouth College, and Dr. Jennie Hunter-Cevera, University of Maryland, Biotechnology Institute).

KSTC, the Kentucky Science and Technology Corporation

KSTC, the Kentucky Science and Technology Corporation, is a statewide, nonprofit science and technology organization founded in 1987 to enhance the capacity of Kentucky citizens, firms, and organizations to use science and technology and effectively compete in the global marketplace.

KSTC is committed to the advancement of science, technology, and innovative economic development founded on Kentucky know-how. KSTC develops and manages creative

initiatives in education, economic competitiveness, and scientific research and is governed by a board of directors comprised of leaders from business, education, and government.

Kris Kimel is President of KSTC.

KSTC board members are:

Chair, J. Ronald Geoghegan, BellSouth Tele-communications, Frankfort;
Vice Chair, Shiela S. Medina, East Kentucky Power Cooperative, Winchester;
Secretary/Treasurer, Sam P. Burchett, Lexington;
Sam S. Anzelmo, Anzelmo & Associates, Inc., Lebanon;
Terry E. Beeler, ALLTEL Communications, Lexington;
Charles H. Bennett, Kentucky State University, Frankfort;
Gary Braswell, MPD Inc., Owensboro;
Douglas F. Cobb, Appriss Inc., Louisville;
Delwood C. Collins, University of Kentucky Medical Center, Lexington;
Charleen Combs, Data Futures Inc., Harlan;
Gary S. Cox, AIKCU, Frankfort;
Alex Day, Sheltowee, LLC, Louisville;
Gerald L. DeMoss, Morehead State University;
Virginia G. Fox, Kentucky Educational Television, Lexington;
Linda P. France, Jessamine County Schools, Nicholasville;
Arnold Gaither, LFUCG Mayor's Training Center, Lexington;
Martin R. Houston, Western Kentucky University, Bowling Green;
Willis Johnson, University of Kentucky, Lexington;
James Jones, Mason Hanger Corporation, Lexington;
Mark Kristy, Pricewaterhouse Coopers LLP, Louisville;
J. Dan Lacy, Ashland Inc., Covington;
William M. Lear, Stoll Keenon & Park LLP, Lexington;
Brack Marquette, Verizon, Lexington;
Nancy C. Martin, University of Louisville, Louisville;
John Mateja, Murray State University, Murray;
Shiela S. Medina, East Kentucky Power Cooperative, Winchester;
John C. Merchant, Peck, Shaffer & Williams LLP, Cincinnati;
Gary Mielcarek, United Parcel Service, Louisville;
Katherine G. Peden, Katherine G. Peden and Associates, Inc., Louisville;
Rogers Redding, Northern Kentucky University, Highland Heights;
Raymond M. Schreck, Louisville;
James C. Seiffert, Stites & Harbison, Louisville;
David Szetela, Louisville;
Lee T. Todd, University of Kentucky, Lexington;
Roy Vasher, Toyota Motor Mfg of KY, Erlanger;
Laura Wilson Voss, Lexmark International, Inc., Lexington;
James C. Votruba, Northern Kentucky University, Highland Heights;
Susan Weiss, NetTango, Louisville; and
Lynn A. Witten, KMAC (KY Manufacturing Assistance Center), Lexington.

ONE, the Office of the New Economy

ONE, HB 572, 2000 Regular Session, established the Office of the New Economy in the Cabinet for Economic Development. Its mission is to lead the statewide initiative to spur the growth of the knowledge-based economy in Kentucky. The 2000 Kentucky General Assembly charged the ONE with developing a statewide strategic plan for the new economy that defines goals, sets priorities, and charts a strategy for success in the new economy. It also identifies performance indicators by which to measure progress made by Kentucky over the next decade.

Dr. Bill Brundage is Commissioner of the Office of the New Economy.

RTC, the Regional Technology Corporations

Regional Technology Corporations were created in HB 572, 2000 Regular Session, to act as intermediary organizations delivering services and providing resources to knowledge-based clusters, primarily in rural areas of Kentucky. Public and private organizations, including comprehensive universities and other postsecondary institutions, could participate in activities organized by the RTCs.

The RTCs were to identify key areas in which the state has comparative advantages, identify the key supplier chains involved, recommend ways to link key suppliers and industry anchors to other industries in a matchmaking function, work with economic development recruitment organizations, and assist in identifying and encouraging companies to fill gaps in supplier chains or serve as anchors for cluster development. They were to serve as regional one-stop clearinghouses to cluster companies and related organizations, identify and support the creation of curricula, short courses, certificate programs, and non-degree programs to meet the workforce training needs of promising industries and clusters, support existing industry associations and help create new associations in emerging industries and clusters. RTCs were to develop regional strategies around their purpose and advocate for and secure public and private resources to implement these strategies.

The section that created the RTCs was repealed and the RTCs were recreated as ICC satellites in HB 525, 2002 Regular Session. The satellites will serve the same function as originally intended for the RTCs but will be attached to the ONE instead of the council.

Research Priority Areas

Research Priority Areas, are targeted research areas where the commonwealth's resources are being focused and Kentucky stands to gain national prominence.

The Office for the New Economy, after consultation with scholars and scientific experts across the commonwealth, identified five research priority focus areas for Kentucky: human health and development, biosciences, information technology and communications, environmental and energy technologies, and materials science and advanced manufacturing.

These research priority areas will afford Kentucky the best opportunity to build centers of research excellence around which competitive technology-based clusters can grow and thrive. These centers and associated business clusters will have the greatest influence on the creation of knowledge-based economy in Kentucky.

III. Introduction and History

HB 525, 2002 Regular Session, calls for the Council on Postsecondary Education to submit an annual report to the Kentucky Innovation Commission, the Governor, and the General Assembly prior to October 15. The report is to detail the Council's work related to the Science and Technology Programs created in KRS 164.6021 (R&D Voucher Program), 164.5029 (Commercialization Fund), and 164.6037 (Rural Innovation Program). The report is to include progress made in achieving each program's purposes, qualitative and quantitative information concerning the applications received, projects approved and undertaken, companies served, funding amounts invested in each project or program, and findings and recommendations to increase each program's effectiveness in achieving its purposes.

The Kentucky Innovation Act, HB 572, 2000 Regular Session, assigned to the council oversight of four initiatives to stimulate research and development, university-business and collaboration, and rural involvement in high-technology growth: the Research and Development Voucher Program, the Commercialization Fund, the Rural Innovation Program, and the Regional Technology Corporations. The section of the Act that created the RTCs was repealed in the 2002 regular session and the RTCs were recreated as satellites to Innovation and Commercialization Centers, managed by the Cabinet for Economic Development's Office for the New Economy, and administered by the Kentucky Science and Technology Corporation.

The Act also required a statewide entrepreneurial audit, and designated the council as the pass-through agent for the Kentucky Science and Engineering Foundation and the Kentucky Experimental Program to Stimulate Competitive Research.

In accordance with the Act, the council contracted with the Kentucky Science and Technology Corporation to conduct the statewide entrepreneurial audit and administer the commercialization investment programs assigned to it. KSTC completed the audit and published its findings in 2001 (www.one-ky.com/plan.html). KSTC also published requests for proposals for each of the programs, received and reviewed applications, and selected grant recipients on the criteria approved by the council on July 30, 2001 (www.cpe.state.ky.us/council/council_073001.asp)

The Act also directed the Commissioner for the New Economy to develop a statewide strategic plan for the New Economy (www.one-ky.com/plan.html). This plan recognizes Kentucky's current position in the knowledge-based economy, identifies knowledge-based economy niches where Kentucky might gain a competitive edge, and establishes the public policy framework necessary to achieve results.

HB 525, 2002 Regular Session, directed the council to continue to contract with KSTC to administer the commercialization investment programs. It also authorizes the Office for the New Economy to approve these contracts with regard to the structure and funding levels of the programs.

IV. Commercialization Investment Programs

The Innovation Act, HB 572, 2000 Regular Session, described a knowledge-based economy blueprint for Kentucky, with programs housed in the council, the Cabinet for Economic Development, and the Kentucky Science and Technology Corporation. The legislation created research and development support programs, provided manufacturing modernization services, and provided the necessary fiscal stimulus to create, attract, incubate, and grow high-tech and biotech firms.

Three programs in particular were created to fund R&D and research commercialization: the R&D Voucher Program, the Rural Innovation Program, and the Commercialization Program. Table 1 shows the balance sheet for these three programs.

The Kentucky Science and Engineering Foundation also was created to invest in applied research to develop emerging technologies. In addition, the Experimental Program to Stimulate Competitive Research, a federal grant program, contributes to core R&D in Kentucky.

**Table 2. KSTC Commercialization Investment Programs
FY July 1, 2001 to June 30, 2002**

<i>Program</i>	<i>2001 Carry Forward</i>	<i>2002 General Fund Appropriation</i>	<i>Budget Reduction</i>	<i>Admin Costs</i>	<i>Awards</i>	<i>Balance</i>
R&D Voucher	0	3,000,000	35,100	96,854	899,667	1,969,379
Rural Innovation	861,500	0	0	96,853	165,700	598,947
Commercialization	0	750,000	8,750	96,853	477,593	166,804
*RTC	0	500,000	5,850	96,853	0	397,297

*RTC program was established in 2000 and repealed and recreated as ICCs in 2002. The 2000 appropriation was transferred to the Office of the New Economy in 2002.

A. R&D Voucher Program \$3 million, FY 2001-02

The R&D Voucher program is a \$3 million investment fund that enables small and medium-sized Kentucky-based firms to undertake research and development in working partnership with Kentucky university researchers. Investments are made in technology refinement, prototype development, and commercial product development. Eligible applicants may receive up to \$200,000 over two years, not to exceed \$100,000 in any one year.

Nine projects were funded during the 2001-02 fiscal year, for a total of \$899,667.

1. *Program Goals*

The program goal is to expand knowledge-driven R&D capacity in Kentucky by investing in innovation and public/private partnerships that lead to new or valued-added companies, jobs, technology, products, processes or services.

Small and medium-sized Kentucky-based companies that seek to undertake research and development will work in partnership with universities in the Commonwealth.

2. *Investment Guidelines*

Project funding in the Kentucky R&D Voucher Fund Program has the following limitations:

1. Voucher award funds from the state fund shall be expended within the university under contract. At least 51% must be spent at the university.
2. The maximum amount of funding is \$200,000 over 2 years not to exceed \$100,000 per year.
3. At a minimum, the qualified company shall match the project award by a one-to-one dollar ratio for each year of the project.
4. All awards are subject to repayment stipulations.

3. *Matching*

Companies must match the fund's investment on a one-to-one dollar ratio, with at least 25% of the match in cash. The remaining match can come from in-kind sources. Universities are able to provide matching dollars and services above and beyond the investment amount awarded by KSTC. Matching in-kind dollars from universities will require a budget to account for dollars being paid in versus in-kind services. In-kind services cannot be comprised of investment dollars from KSTC. No funds that have been generated through any state source shall be used as matching funds. KSTC has sole discretion to authorize an in-kind contribution in lieu of part of the industry match if KSTC determines that the financial limitations of the qualified company warrant this authorization.

4. *Investment Preconditions*

Prior to being certified for investment funding, the qualified company shall:

- Negotiate an agreement and funding contract with a university in the Commonwealth that is satisfactory to KSTC to undertake the research and development work; and
- Provide assurance to KSTC that the university and the qualified company have negotiated the ownership and disposition of patents, royalties, all other intellectual property rights, and equity or related position between the qualifying company and the university as it relates to the contract.

- Prior to certifying a qualified company, KSTC may negotiate with the qualified company the ownership and disposition of patents, royalties, all other intellectual property rights, and an equity or related position on behalf of the Kentucky R&D Voucher Fund for the sole purpose of reinvesting and sustaining a revolving fund to carry out the related provisions of the Kentucky Innovation Act.
- KSTC will only fund one award per company per annual funding cycle.

5. *Application Process*

1. Submit a business plan to an ICC office. Companies are expected to have a fully developed business plan containing detailed market focus and research. This better aligns investment criteria with company lifecycle.
2. If the business plan receives a passing score, the company will be notified that it may submit an application.
3. Company will submit a formal application to KSTC. An authorized university officer must sign each application.
4. KSTC will review the business plan and the formal application and will conduct market analysis.
5. If the market is promising, KSTC will conduct a face-to-face interview with the applicant and his or her team.
6. The company will be asked to submit a technical brief.
7. The technical brief will be evaluated.
8. KSTC will review all materials and make recommendations to an external review panel.
9. The executive committee of KSTC will review applications.
10. A contract will be negotiated.
11. Applications are funded.

NOTE: At any point in the process an applicant may be notified that he or she was not funded.

6. *Application*

- Statutory requirements and KSTC guidelines are listed on the application.
- Applicant must be invited to submit a formal application. The first step in the application process is to submit a business plan to the regional ICC office. The regional ICC office will notify the applicant if the business plan is eligible for funding.
- Applications must be received on or before the specified date (5p.m. EST).
- After the application and business plan have been reviewed the applicant may be asked to submit a technical brief.

7. 2001-02 Awards

Table 3. Nine R&D Voucher projects funded in 2001-02, total \$899,667

<i>Company</i>	<i>Applicant</i>	<i>University Partner</i>	<i>Project Description</i>	<i>Research Priority Area</i>	<i>Award</i>
Murty Pharmaceutical, Inc. (Lexington)	Ram Murty	Murray State University	Sustained-release antibiotic gel for delivering compounds that prevent/treat infections	Human Health & Development	\$100,000
NetQuest Services (Louisville)	Cris Anderson	University of Louisville	Remote temperature monitoring, for early diagnosis Bovine Respiratory Disease	Biosciences	\$99,732
TreeGuide, Inc. (Lexington)	Tom Kimmerer	University of Kentucky	Landscape management technology, reduces irrigation, fertilization planting costs	IT & Communications	\$100,000
ArchVision, Inc. (Lexington) (Project Withdrawn)	Randall Stevens	University of Kentucky	Photorealistic 3D visualization, simulation software used in architecture, interior and industrial design, urban and military planning	IT & Communications	\$99,935
Buckman Jet Drilling (Bowling Green)	Bill Buckman	Western Kentucky University	Fluid jet drill system, increases production from oil/gas and coal bed methane wells	Environmental and Energy Technologies	\$100,000
ChipRx (Lexington)	Patricia Eisenhardt	University of Kentucky	Drug delivery implant, personalized to individual's body chemistry to treat heart disease, diabetes, etc.	Biosciences	\$100,000
LevTech, Inc. (Lexington)	Philip Mantey	University of Kentucky	Superconductive levitation mixer for sterile high-purity fluid	Materials Science & Advanced Manufacturing	\$100,000
Medeqco Medical Technologies, LLC (Louisville)	Kai Trompeter	University of Louisville	Patient warming device	Human Health & Development	\$100,000
Metal Chelation Chemicals (Lexington)	David Atwood	University of Kentucky	Chemical product that irreversibly binds toxic heavy metals (e.g., mercury, cadmium) for treating contaminated soils	Environmental & Energy Technologies	\$100,000

B. Rural Innovation Program, Level 1 and Level 2
\$1 million, FY 2000-01 (Carried forward into FY 2001-02)

The Rural Innovation program is a \$1 million investment fund, and assists small, rural, Kentucky-based firms to undertake research and development. Funds must be used in partnership with a university or an appropriate third party. Investments are made in proof of concept development and early stage prototyping.

Pursuant to guidelines adopted by the council, an applicant eligible for Level 1 funding may receive up to \$7500, in the form of a grant. An applicant eligible for Level 2 funding may receive up to \$50,000 over two years, not to exceed \$25,000 in either year. Awards under \$25,000 are considered grants, awards over \$25,000 may be subject to repayment.

Nine Rural Level 1 projects were awarded in 2001-02, for a total of \$66,500. Four Rural Level 2 projects were awarded for a total of \$99,200. Rural Innovation awards totaled \$165,700.

1. Purpose

Pursuant to guidelines adopted by the council, the purpose of the Level 1 Rural Innovation Fund is to provide pre-seed (pre-angel investment) money to small and medium sized rural Kentucky businesses that are seeking to commercialize a technology, process, or product.

An appropriate company applicant is one that has a product with patentable technology and a clear market. Specifically, the applicant should have a product that is innovative and new or improved technology that will drive the economy. Infrastructure funding is not included.

2. Award Amount, Level 1

The maximum of funding available for a Level 1 award is \$7500.

This award is available only one time to each company that qualifies. To compete for these funds, the applicant must complete a formal application by the deadline date.

KSTC will not reimburse past company expenses but will pay for work that is agreed upon for a specific project. Work should not be started until the company has been given written permission. KSTC does not reimburse expenses that were completed before written approval.

3. *Eligibility Requirements*

- The company must be located in rural Kentucky. Rural is defined as any county outside of Fayette, Jefferson, Campbell, Kenton, and Boone counties.
- The company must have less than 50 employees.
- All funds must be spent with a third party on behalf of the company. The company can hire a consultant, a university partner, or a service provider. The money cannot be used to pay company salaries or overhead. NOTE: If the company is contracting with a university, the agreement with the university regarding licensing or acquisition of intellectual property must be in place prior to applying and is subject to review by KSTC.
- The company must be able to demonstrate a clear potential to lead to a commercially successful product, service, or process.

4. *Application Process*

1. Submit an application directly to KSTC by the deadline date.
2. KSTC will review the application.
3. KSTC will conduct a face-to-face interview.
4. KSTC will review and make recommendations to an external review panel.
5. The executive committee of KSTC will review applications.
6. A contract will be negotiated.
7. Applications are funded.

NOTE: At any point in the process an applicant may be notified that he or she was not funded.

5. *Application*

- Guidelines are listed on the application.
- Applications must be received on or before the specified date (5p.m. EST).

6. Awards, 2001-02

Table 4. Nine Rural Level 1 awards granted in 2001-02, total \$66,500

<i>Company</i>	<i>Applicant</i>	<i>Project</i>	<i>Project Description</i>	<i>Research Priority Area</i>	<i>Award</i>
B&B Sales, Inc. (Winchester)	Ben Falmlen	Pulse Trainer	Weightlifting device improves athletes' aerobic isometric workout	Human Health & Development	\$7500
Immpheron, Inc. dba ChemClark (Winchester)	Heinz Kohler	ChemClark	Designer drugs for patients	Biosciences	\$6500
Crocus Creek (Harrodsburg)	Alan Hadley	PlanMaster	Software, home woodworker, design furniture, create work list	IT & Communications	\$7500
Kentucky Enrichment (Utica)	Neil Van Milligen	Chicken House Heating	A new linear radiator systems to substitute efficient hot water heat for the antiquated open flame propane brood heaters now used to raise young birds	Environment & Energy Technologies	\$7500
Nebecor (Clay City)	Terry Hunsucker	Crankshaft	Business plan development for a company who has designed a new crankshaft	Materials Science & Advanced Manufacturing	\$7500
NeuroTek (Goshen)	Jon Cowan	Neurofeedback	Neurofeedback software system to train users to concentrate and relax	IT & Communications	\$7500
RevStream (Ashland)	Barbara Wagner	Medical Oxygen	Compressed oxygen delivery to home health	Biosciences	\$7500
Watersteel (Winchester)	Jerry Brumagen	Steel Processing	Business plan for steel manufacturing process	Materials Science & Advanced Manufacturing	\$7500
HitCents.com (Bowling Green)	Ed Mills	Website/Banner Ad Development	Business plan for software company managing banner ads on web sites	IT & Communications	\$7500

8. *Award Amount, Level 2*

The maximum funding available for a Level 2 award is \$50,000 over two years, not to exceed \$25,000 in any give year (totals include prior Rural Level 1 investments).

Awards under \$25,000 are considered grants and are not subject to repayment stipulations.

Awards over \$25,001 are not grants and are subject to repayment stipulations. This means that either the applicant is expected to pay the money back either 2X over five years or KSTC will take an equity stake in the company. If the company is unable to generate revenue, KSTC will not force repayment.

KSTC will only fund one award per company per funding cycle.

9. *Eligibility Requirements*

- The company must be located in rural Kentucky. Rural is defined as any county outside of Fayette, Jefferson, Campbell, Kenton, and Boone counties.
- The company must have less than 100 employees.
- All funds must be contracted to a third party. The company can hire a consultant, a university partner, or a service provider. The money cannot be used to pay company salaries or overhead. NOTE: If the company contracts with a university, the agreement with the university regarding licensing or acquisition of intellectual property must be in place prior to applying and is subject to review by KSTC.
- The applicant must have an invention that is new or improved and is commercially viable. The invention may be a process, a technology, or an actual product but in any case it must be able to be protected as intellectual property for it to have market potential.
- The applicant must demonstrate a clear potential to lead to a commercially successful product, service, or process.
- The applicant must have a business plan that meets application standards. If there is no business plan, the applicant may apply for a Rural Level 1 award and use up to \$7500 to contract with a third party for the development of a business plan.

10. *Application Process*

1. Submit a business plan to an ICC office.
2. The ICC will score the business plan.
3. If the business plan receives a passing score, the company will be notified that it may submit an application to KSTC.
4. The company will submit a formal application to KSTC. A third party consultant or an authorized university officer must sign the application.
5. KSTC will review the business plan and the formal application and will conduct market analysis.

6. If the market is promising, KSTC will conduct a face-to-face interview with the applicant and its team.
7. The company will be asked to submit a technical brief.
8. The technical brief will be evaluated.
9. KSTC will review all materials and make recommendations to an external review panel.
10. The executive committee of KSTC will review applications.
11. A contract will be negotiated. This includes the payback stipulations.
12. Applications are funded.

NOTE: At any point in the process an applicant may be notified that he or she was not funded.

The application and review process was developed along the lines of private venture capital processes for analyzing and evaluating investment opportunities.

Application

- Guidelines are listed on the application.
- The applicant must be invited to submit a formal application. The first step in the application process is to submit a business plan to the regional ICC office. The regional ICC office will notify the applicant if the business plan is eligible for funding.
- Applications must be received on or before the specified date (5p.m. EST).

Awards, 2001-02

Table 5. Four Rural Level 2 awards granted in 2001-02, total \$99,200

<i>Company</i>	<i>Applicant</i>	<i>Project</i>	<i>Project Description</i>	<i>Research Priority Area</i>	<i>Award</i>
Irvine Technologies, LLC (Irvine)	Doug Thorpe	Combustion Engine	Internal combustion engine, increases efficiency, extends lifetime, decreases manufacture cost	Materials Science & Advanced Manufacturing	\$24,200
Profile Systems Design Group (Madisonville)	Jon Love	TransActPOS	Retail point-of-purchase software, fulfills accounting and inventory needs	IT & Communications	\$25,000
Two Dimensional Instrument, LLC (Crestwood)	Rick Kaestner	ThermaViewer	Temperature tracking device for monitoring food storage	Materials Science & Advanced Manufacturing	\$25,000
Eagle Environmental Products, LLC (Pikeville)	Jim Patton	Mercury Contamination Clean-up	Chemical agent in environmental industries, binds mercury from waste streams, contaminated soils	Environment & Energy Technologies	\$25,000

C. Commercialization Program
\$750,000, FY 2001-02

The Commercialization fund has \$750,000 to invest in university faculty who want to translate their research into marketable products. Kentucky university researchers, as the eligible applicants, may receive up to \$225,000 per project over three years, not to exceed \$75,000 in any one year.

Seven projects were funded in 2001-02, for a total of \$477,593.

Purpose

The purpose of the Kentucky Commercialization fund is to help commercialize a process, product, or invention that is created or improved at an accredited university or college in the Commonwealth. The applicant must be a faculty member at such an institution in order to apply. The hope is that the faculty member will be able to license this technology or start his or her own company following this investment in the technology.

An application that fits KSTC requirements would be one that develops a prototype for the ultimate goal of commercializing the technology.

Eligibility

The applicant must be a faculty member at a postsecondary institution in Kentucky. The project must focus on the commercialization of a technology that could be protected as intellectual property.

Investment Preconditions

Prior to final approval of fund awards, the university submitting the proposal shall provide assurance to KSTC that the collaborating parties have adequately addressed the ownership and disposition of patents, royalties, and all other intellectual property rights, and an equity or related position between the qualifying company and a partnering entity as it relates to the contract.

Prior to approval of funding awards, KSTC may negotiate with the university the ownership and disposition of patents, royalties, all other intellectual property rights, and an equity or related position on behalf of the Kentucky Commercialization Program for the sole purpose of reinvesting and sustaining a revolving fund to carry out the provisions of the fund.

Project funding in the Kentucky Commercialization Program has the following limitations:

1. The maximum amount of funding for a project is \$225,000 over three years not to exceed \$75,000 per year.

2. The University of Kentucky and the University of Louisville shall be awarded together no more than seventy percent (70%) of fund awards per funding cycle.
3. Awards are subject to a royalty repayment agreement with the university.

Application Process

1. The applicant submits an application directly to KSTC by the deadline. An authorized university officer must sign the application.
2. KSTC will review the application.
3. If the application fits the scope of the program the applicant will be invited for a face-to-face interview.
4. KSTC will review and make recommendations to fund the application to an external review panel.
5. After successfully passing the review panel, applications will be recommended to the executive committee of KSTC for approval.
6. A contract will be negotiated.
7. Applications are funded.

NOTE: At any point in the process an applicant may be notified that he or she was not funded.

Application

- Guidelines are listed on the application.
- Applications must be received on or before the specified date (5p.m. EST).

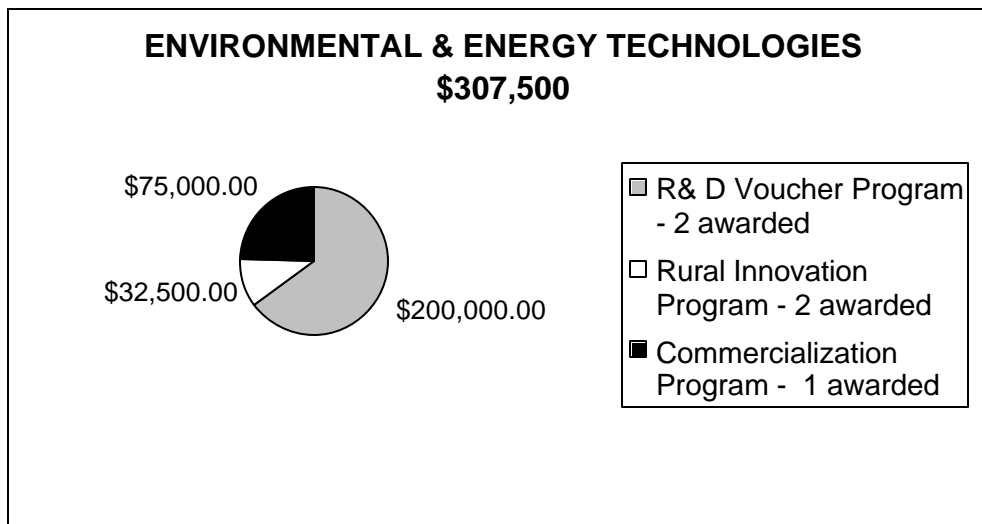
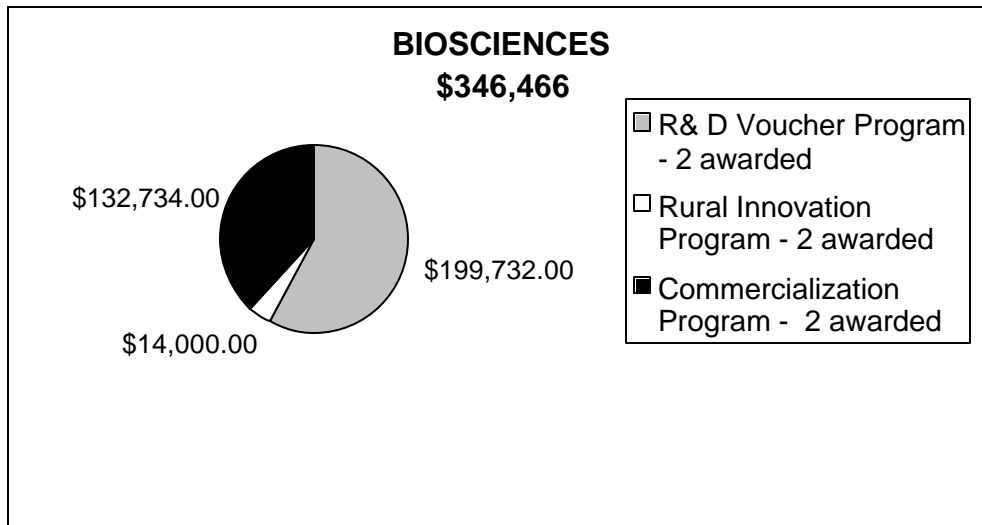
Awards, 2001-02

Table 6. Seven Commercialization projects funded in 2001-02, total \$477,593

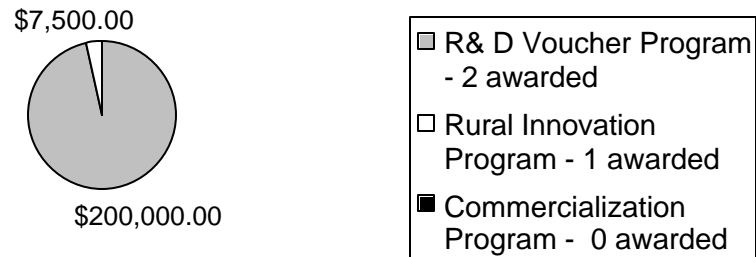
<i>University</i>	<i>Applicant</i>	<i>Project title</i>	<i>Project Description</i>	<i>Research Priority Area</i>	<i>Award</i>
Northern Kentucky University	Rebecca White	5/3 Bank Entrepreneurship Institute	Business plan assessment for statewide ICC network	IT & Communications	\$74,859
University of Louisville	John Naber	Assenti	Technology for glaucoma, monitors intraocular pressure outside doctor's office	Biosciences	\$67,439
University of Louisville	Mark Brennan	PsychGenome	Gene mapping to aid new drug development, psychological disorder diagnosis and treatment	Biosciences	\$65,295
University of Louisville	James Zanewicz	Technology Transfer Office	Technology transfer workshops for Kentucky colleges and universities	IT & Communications	\$45,000
University of Kentucky	Joseph Fink III	Intellectual Property Development Office	Intellectual Property outreach between UK/UofL and other Kentucky campuses	IT & Communications	\$75,000
University of Kentucky	William (Benjy) Mikel	Food Incubator	Commercial food processing techniques to enhance safety, processing, packaging for agriculture and food industries	Materials Science & Advanced Manufacturing	\$74,960
Western Kentucky University	Nicholas Crawford	Center for Karst and Cave Studies Research	Remote controlled device searches for disaster survivors around the world	Environmental & Energy Technologies	\$75,000

4. Total CIP Awards, by Research Priority Area, 2001-02

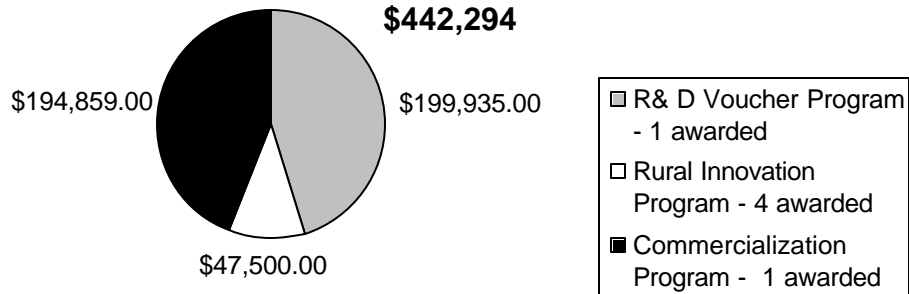
There was a total of \$1,542,960 awarded in 2001-02. The funds were awarded as follows:



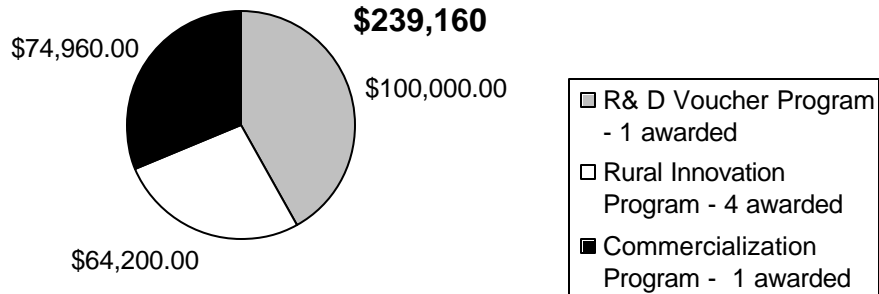
HUMAN AND HEALTH DEVELOPMENT \$207,500



INFORMATION TECHNOLOGY & COMMUNICATIONS \$442,294



MATERIALS SCIENCE & ADVANCED MANUFACTURING \$239,160



V. Kentucky Science and Engineering Foundation
\$1.8 million, Carried forward from FY 2000-01
\$2.0 million, FY 2001-02

Table 7. Kentucky Science and Engineering Foundation, 2001-02

	2001	2002	
Brought Forward		1,863,389	
Allocation	2,000,000	2,000,000	
KSTC Interest	19,306	64,388	
Subtotal	2,019,306	3,927,777	
Awards	0	(1,956,692)	*
Administration	(155,917)	(363,074)	
Carry Forward	(1,863,389)	0	
Subtotal		1,608,011	
Pipeline		(150,000)	
Current Balance	0	1,458,011	

* - Includes \$388,692 from 2000-01 allocation.

The Kentucky Science and Engineering Foundation is a new organization created in HB 572, 2000 Regular Session, to build R&D excellence in the commonwealth, particularly in Kentucky's priority research focus areas. HB 572 directed the Kentucky Science and Technology Corporation to create and manage the Kentucky Science and Engineering Foundation. KSEF is operated by KSTC through a contract with the council. By making investments in peer-reviewed science and engineering research and by attracting more research funding from all sources to the commonwealth, KSEF is a means to increase Kentucky's capacity to become a leader state in competitive research. KSEF is modeled in part on the National Science Foundation, makes investments in peer-reviewed science and engineering research, and works to increase federal and private sector funding for R&D in Kentucky.

KSEF had available \$1,863,389 in 2001-02 from unspent 2000-01 funds and was appropriated \$2 million in 2002. KSEF funded 32 grant proposals in 2001-02, for a total of \$1,956,962 in research grants, which included \$388,692 from 2000-01 and \$1,568,000 from 2001-02.

KSTC board of directors established four KSEF program priorities for the 2000-02 biennium.

A. R&D Excellence Research Categories

1. Exploratory Advanced Research

Research activity conducted to advance the basic research already undertaken to further discover and understand the causes, effects, or relationships between various components of a research project. The research results will add new knowledge or understanding that

is likely to bring recognition to the researchers, additional competitive grants, and better students.

2. Purpose-Driven Research

Research activity conducted to explore potential application of the advanced research to the solution of one or more technical problems leading to the possibility of a process or a new product development. Research results will likely result in the creation of intellectual property. The efforts are directed to examine early feasibility of a targeted purpose towards developing a technology.

3. Emerging Technologies

Research and development activity is conducted to advance the early feasibility results of purpose-driven research to provide a more definite outcome of results in the development of a new product or a process technology. The work conducted here is likely to strengthen the intellectual property with additional patents or as a proprietary information or know-how. The results of this activity are likely to be packaged as a ‘technology’ and will set a stage for technology transfer activity.

4. Emerging Ideas

Research activity is undertaken as a preliminary work on high-risk, untested, novel ideas allowing researchers to venture into emerging research areas ahead of others. Research results are likely to be used as preliminary results in competing for federal funds and in getting the researchers recognized as pioneers in that potential new area by their early publication of the new concepts. This is a high-risk investment in making Kentucky a leader state in coming years.

B. Selection Process

1. The Review Process

267 reviewers from 38 states and Canada produced at least three reviews for each proposal. These reviewers were selected through contacts with 1,022 external experts from throughout the United States and Canada.

For each proposal, the reviewers provided a numerical score based on the content of the proposal and in comparison to other proposals previously reviewed in that subject area.

2. Peer Review Evaluation Criteria

Each reviewer evaluated the proposal based on the following evaluation criteria:

Rationale – The degree to which the proposal addresses an important issue, problem, or opportunity in development and use of its results.

Scientific or Professional Merit – The degree to which the activity advances the state of science or discipline through use and extension of state-of-the-art methods.

Innovation – The degree to which new approaches to solving problems and exploiting opportunities in resource management or development, or in public outreach, on such issues are employed, or alternatively, the degree to which the activity focuses on new types of important or potentially important resources and issues.

Qualifications and Past Record of Investigators – The degree to which investigators are qualified by education, training, and/or experience to execute the proposed activity, and their record of achievement with previous funding.

Facilities and Equipment – The degree to which the investigators have adequate facilities and equipment to conduct the proposed research or R&D.

3. Selection Criteria

Consideration was given to the quality of the research, matching funds, the benefit to the state, and the research focus in Kentucky when making awards. The following selection criteria were applied in conjunction with the technical reviews to select the winning proposals:

Relevance to State's Priority Research Areas – Projects demonstrating the greatest relevance to the current priority research areas of the Commonwealth receive the greatest consideration.

Kentucky Focus – Projects with a focus on issues and problems of relevance to the Commonwealth.

Soundness of Scientific Principles – Soundness of approach and experimental design as judged by the external expert peer reviewers.

New Innovation Opportunity – The degree to which the proposed project is likely to foster and sustain innovation, and the potential impact it may have on economic and/or societal well-being.

Education and Dissemination – The results of the project that may be distributed broadly and result in greater public understanding of the problem. The information should be useful not only to the scientific community but also to policy makers and stakeholder groups.

Project Success – Probability of success of the proposed project in a timely manner. Depending on the nature of the project, the project results in greater understanding of the problem or in the ultimate resolution of an identified problem.

Appropriate Budget – Appropriateness of the proposed budget given the level of effort proposed. Proposed costs must be reasonable in light of the anticipated project benefits.

Performance Capability – The prior experience and the resources of the applicant ensures their capability to perform the work being proposed.

Appropriate Fit and Lack of Duplication – The applicant shows originality of ideas and how the proposed project complements, as appropriate, the previous, ongoing or other planned efforts. KSEF funds are not used to support a project currently funded through another source of state funds.

Funding Sources – Share of other funding sources in relation to the Commonwealth funds to support applicant's work shows resourcefulness of the applicant. Projects if supported by funds from non-state sources receive special consideration.

Matching Funds – A dollar-for-dollar match is required, in cash or in-kind from the grantee organization for projects funded under three project categories: exploratory advanced research, purpose-driven research, and emerging technologies. The indirect cost rate (overhead rate) is limited to ten percent. If requested, the difference in the actual rate could be met with state funds and credited toward the required match. Preference is given to projects that can demonstrate cost-sharing in cash or in-kind from private, federal, and sources other than the state.

C. Recommendation and Approval Process

The KSEF Advisory Board was appointed by Kentucky Science and Technology Corporation Board of Directors and is composed of scientists, engineers, and administrators from academia and corporate sectors in Kentucky and other states.

Dr. Mahendra Jain is Executive Director of the Foundation. The KSEF Advisory Board members are:

- the University of Kentucky (Dr. Jim Boling) and UofL (Dr. Nancy Martin) Research Vice Presidents,
- two EPSCoR members from the comprehensive universities (Dr. Blaine Ferrell, Western Kentucky University, and Dr. Tejinder Kochhar, Kentucky State University),
- one member from the independent colleges or universities (Dr. James Miller, Transylvania),
- three corporate representative (Roger Dingus, UPS, Ed McInerney, General Electric, John Zbrozek, Lexmark International),
- and three members with science and engineering connections outside Kentucky (Dr. Charles Kupchella, University of North Dakota, Dr. Charles Wyman, Dartmouth College, and Dr. Jennie Hunter-Cevera, University of Maryland, Biotechnology Institute).

The Advisory Board unanimously concurred with the findings of the 267 external reviewers and recognized the professional and impartial peer review and recommendation process implemented by KSEF.

Based upon the recommendations of the Executive Director of KSEF and its Advisory Board, the Kentucky Science and Technology Corporation Board of Directors approved 32 projects under the R&D Excellence Program of KSEF.

Table 8. Distribution of KSEF awards in 2001-02

<i>Emerging Ideas (\$101,138)</i>				
<i>University</i>	<i>Applicant/Principal Investigators</i>	<i>Project title</i>	<i>Research Priority Area</i>	<i>Award</i>
University of Kentucky	William Douglas, Charles Knapp, Jamey Jacob	Controller unit for an adjustable systemic-pulmonary artery shunt	Human Health & Development	\$14,950
University of Kentucky	Mark Thomas, Ibrahim Jawahir, Kozo Saito	Optimization of drill design and coolant delivery systems for dental implant osteotomy preparation	Human Health & Development	\$10,450
University of Kentucky	Avindra Nath, Ashok Chauhan	Development of diagnostic techniques for novel viral pathogens in the era of bio-terrorism	Biosciences	\$16,500
University of Louisville	Theresa Chen	Nutritional modulation of glutathione status and longevity	Biosciences	\$16,500
University of Kentucky	Krishnamurty Muralidhar	A theoretical framework for data masking	IT & Communications	\$13,673
University of Kentucky	Bruce Hinds	Synthetic route for carbon nanotube based permeable membrane	Materials Sci & Adv Mfg	\$15,000
University of Kentucky	Michel Jabbour	Phase segregation and the influence of microstructure on the growth of multispecies thin solid films	Materials Sci & Adv Mfg	\$14,065
<i>Emerging Technologies (\$391,448)</i>				
University of Kentucky	David Hildebrand, Peter Nagy	Efficient leaf aldehyde production	Biosciences	\$68,302
University of Louisville	Amo Spatola	Combinatorial drug discovery through constrained macrocyclic libraries	Biosciences	\$68,302
Immpheron Inc.	Sybille Muller, Heinze Kohler	Superantibodies: Tool for cell penetration as intercellular diagnostic markers and potential therapeutic drugs	Human Health & Development	\$38,109

<i>Emerging Technologies (continued)</i>				
<i>University</i>	<i>Applicant/Principal Investigators</i>	<i>Project title</i>	<i>Research Priority Area</i>	<i>Award</i>
University of Kentucky	Daniel Tao, Rick Honaker	Development of advanced simultaneous fine coal dewatering and reconstitution process for energy recovery and environmental protection	Environment & Energy Technology	\$72,541
University of Kentucky	Vijay Singh, John Anthony	Fabrication and characterization of solar cells based on organic semiconductors	Environment & Energy Technology	\$73,962
University of Kentucky	Rick Honaker, Daniel Tao	Combined enhanced gravitation and surface forces for improved energy recovery	Environment & Energy	\$70,232
<i>Exploratory Advanced Research (\$974,088)</i>				
University of Kentucky	Eric Vanzant, John Johns, Keith Schillo, Larry Turner, Darrh Bullock, Rich Gates	Remote, continuous temperature detection in beef cattle	Biosciences	\$93,469
University of Kentucky	James Geddes, Avi Nath	Protein transduction domains for novel therapeutic agents	Biosciences	\$94,886
University of Kentucky	Anne-Frances Miller	Engineering desired catalytic activity into superoxide dismutase	Environment & Energy Technologies	\$95,000
University of Louisville	M. Keith Sharp	Investigation of the mechanisms of flow-induced hemolysis	Biosciences	\$95,817
University of Kentucky	Barbara Knutson, Stephen Rankin	Adsorption and recovery of dilute fluorinated surfactants for non-aqueous cleaning applications	Biosciences	\$90,000
University of Louisville	Barbara Burns	An examination of temperament and attention in children attending head start	Human Health & Development	\$46,196
University of Louisville	Craig McClain, Shirish Barve, John Klein	Innovative approaches in non-alcoholic steatohepatitis	Human Health & Development	\$110,000
University of Louisville	Mary E. Bradley	The effects of antibiotic rotation on bacteria in intensive care units	Human Health & Development	\$64,913

<i>Exploratory Advanced Research (continued)</i>				
University of Kentucky	Chi-Sing Man, Tongguang Zhai	Residual Stress and Texture in surface-enhanced titanium alloy: Their nondestructive inspection and effects on high-cycle fatigue properties	Materials Science & Adv Mfg	\$95,174
University of Kentucky	I.S. Jawahir	Predictive models for dry machining of aluminum alloys for automotive manufacturing industry	Materials Science & Adv Mfg	\$95,190
University of Kentucky	Clyde Holsapple	Exploring the knowledge chain in E-business and knowledge-driven enterprises	Information Technology & Communications	\$93,443
<i>Purpose Driven Research (\$490,018)</i>				
<i>University</i>	<i>Applicant/Principal Investigators</i>	<i>Project title</i>	<i>Research Priority Area</i>	<i>Award</i>
University of Kentucky	Peter Nagy	Development of novel biotechnology tool based on RNA recombination	Biosciences	\$43,936
Morehead State University	Benjamin Malphrus, Jeff Kruth, Stephen Currier	Development of radio frequency research laboratory and development of RF to digital systems for satellite telecommunications applications	Information Technology & Communications	\$57,099
University of Kentucky	Suzanne Weaver Smith, Jack Leifer	Evaluation of surface patterns for in-plane measurement of thin-film structures	Materials Science & Adv Mfg	\$53,991
University of Kentucky	Czarena Crofcheck, Michael Jay, Paul Bummer	Improved recovery of engineered pharmaceutical proteins from tobacco plant extract	Biosciences	\$50,393
University of Kentucky	Fred Payne, Larry Holloway	Development of imbedded processor platform for intelligent sensors	Biosciences	\$54,005
University of Kentucky	Guangxiang Luo	Development of high-throughput screens for discovery of novel inhibitors against hepatitis C virus	Human Health & Development	\$81,640
Western Kentucky University	Kaveh Khatir, George Wakileh, Neal Downing, Ronald Rizzo	Advanced research into application of solar energy to residential and commercial units	Environment & Energy Technology	\$74,190
University of Kentucky	Peter Hardy, Ranu Jung	Monitoring recovery from spinal cord injury using magnetic resonance imaging	Biosciences	\$74,764

**VI. Experimental Program to Stimulate Competitive Research
\$2,626,200 million, FY 2001-02**

**Table 9. Kentucky Experimental Program
to Stimulate Competitive Research , 2001-02**

	<i>2001</i>	<i>2002</i>
Brought Forward		1,234
Allocation	2,564,600	2,626,200
KSTC Interest	1,234	1,317
Subtotal	2,565,834	2,628,751
Awards	(2,429,600)	(2,342,600)
Administration	(135,000)	(175,000)
Budget Cut	0	(104,600)
Carry Forward	(1,234)	0
Subtotal		6,551
Lapse		4,000
Current Total	0	2,551

EPSCoR was created in 1978 in response to congressional concern over the inability of some states to compete for federal research and development grants and contracts. Kentucky began participating in the program in 1986 and since that time scientists and engineers at the commonwealth's universities have received awards from all major federal agencies with EPSCoR programs: Department of Energy, Department of Defense, Environmental Protection Agency, NASA, National Institutes of Health, National Science Foundation, and the US Department of Agriculture.

The Kentucky EPSCoR program is a leader in building a statewide infrastructure that promotes national research competitiveness. The Kentucky EPSCoR programs have advanced development of Kentucky's two research institutions as preeminent research-intensive universities and cultivated talent in mathematics, science, and engineering research, and education, contributing significantly to Kentucky's postsecondary education reform. Kentucky's scientists and engineers have won awards from all of the federal EPSCoR programs for which the state is eligible and hundreds of faculty and students at eighteen colleges and universities in the Commonwealth have participated in EPSCoR projects.

Kentucky EPSCoR's program's mission is to enhance the research and intellectual capacity of Kentucky universities and colleges by building and coordinating strategic investments in human capital and the physical infrastructure necessary for Kentucky to compete for federal R&D funding. To date, \$95 million in federal EPSCoR funding has been received, and much of that research has helped EPSCoR researchers to compete successfully for an additional \$175 million from non-EPSCoR sources.

Kentucky EPSCoR also promotes creation and expansion of industry-university partnerships. Through collaborative efforts and cooperative funding, these partnerships

are able to support the continuum of student learning through goal-oriented research and build the technological infrastructure essential to ensuring a competitive Kentucky economy.

EPSCoR-supported activities, such as microdevices, carbon nanotubes, machine perception and object recognition, physiological changes associated with micro-gravity, molecular structural diagnostics and dynamics, computerized imaging, energy processing and aquatic biochemistry, are at the cutting edge of research. Each of these research areas has the potential to develop into a thriving industry in Kentucky, conceived and implemented by new, entrepreneurial firms.

The Statewide EPSCoR Committee, composed of leading scientists, university administrators, and representatives from the private and public sectors, manages Kentucky EPSCoR. It operates as a quasi-independent committee of the KSTC, which houses the Statewide EPSCoR Committee office.

Dr. Wimberly Royster is Kentucky's EPSCoR Chair. The Statewide Committee is composed of nineteen members with statewide representation. Members include six university administrators, seven faculty researchers, and six private/public representatives. The university administrators must have experience in basic science and engineering supported by federal agency EPSCoR programs. The faculty members must have well-established records of external funding in basic science and engineering supported by federal agency EPSCoR programs. The private/public sector representatives must have backgrounds in science and/or engineering. All members of the Statewide EPSCoR Committee are expected to have an understanding of current science policy and related areas.

Members of the Statewide EPSCoR Committee are:

Ms. Judi Streepey, Vice Chair;
Mr. Richard Alloo, General Manager, Toyota Motor Manufacturing North American, Inc.;
Dr. Jim Boling, VP for Research, University of Kentucky;
Dr. Del Collins, Associate Vice President for Research, University of Kentucky;
Dr. David Cohn, Department of Biological & Biophysical Sciences, School of Dentistry, University of Louisville;
Dr. Blaine Ferrell, Dean, Ogden College of Science, Health & Technology, Western Kentucky University;
Dr. Eric Grulke, Advanced Carbon Materials Center, University of Kentucky;
Dr. Rick Kurzyske, Lexington, Kentucky;
Dr. T.S. Kochhar, Department of Biology, Kentucky State University;
Dr. John Mateja, Director, Undergraduate Research and Scholarly Activities, Murray State University;
Dr. Nancy Martin, Vice President of Research, University of Louisville;
Dr. Rogers Redding, Vice President for Academic Affairs and Provost, Northern Kentucky University;

Dr. Bob Stout, Chairman, Dept of Microbiology, University of Louisville;
Mr. Ken Tuggle, Frost, Brown, Todd LLC, Louisville, Kentucky;
Dr. David White, Center for Reservoir Research, Murray State University; and
Dr. Marta Cecilia Yappert, Department of Chemistry, University of Louisville.

EPSCoR Subcommittee Chairs are:

Dr. Richard Hackney, Chair, NASA EPSCoR Program, Department of Physics & Astronomy, Western Kentucky University;
Dr. Darrell Chenoweth, Chair, DoD EPSCoR Program, Department of Electrical Engineering, University of Louisville;
Dr. John Connolly, Chair, NSF EPSCoR, University of Kentucky; and
Dr. John Stencil, Chair, DOE EPSCoR Center for Applied Energy Research, Lexington, Kentucky.

The Statewide Committee spearheads new policies and resources, promotes rigorous merit review processes, keeps EPSCoR responsive to state and regional needs, and cultivates broad-based support for science, technology, and innovation. The committee works with and through a network of dedicated partners - federal, academic, public, and private sectors - and coordinates the activities of its subcommittees which are responsible for individual agency programs. It also ensures that research support by EPSCoR has the potential to meet national research and development standards of excellence and is consistent with Kentucky's economic and human resource development goals.

EPSCoR contributions to Kentucky include:

- Initiating the discussions and, through the KSTC, producing the Kentucky Science & Technology Strategy for the Commonwealth;
- Cultivating the basis on which a prestigious, five-year, \$11 million NSF Materials Research Science and Engineering Center program was awarded to the University of Kentucky;
- Establishing the infrastructure for nationally recognized microfabrication and microsensor research at the University of Louisville and the University of Kentucky;
- Promoting establishment of new doctoral research opportunities at Murray State University through the University of Louisville;
- Promoting and training statewide university and industrial researchers in entrepreneurship and enterprise development;
- Sponsoring "Phase 0" support to help academic researchers team with industry to obtain Small Business Innovative Research and Small Business Technology Transfer grants;

- Supporting basic research at Kentucky's universities that has led to nationally competitive SBIR awards for technology commercialization;
- Forming a statewide college student-business network to encourage and facilitate entrepreneurship and to foster commercialization of intellectual properties;
- Funding multi-investigator and multi-university research centers and institutes that either are or have the potential to be nationally competitive; and
- Enhancing the pipeline of qualified students in math and science.

Four new EPSCoR initiatives have been created to build human capital, increase the Commonwealth's science and technology infrastructure, improve cooperation among researchers in the Commonwealth, and promote multi-institutional cooperation in key areas.

Research Incubation Grants support emerging concepts and proposals using focused workshops, electronic meetings, and innovative planning activities. This initiative enables meetings and discussions between researchers in Kentucky and national experts, nurtures assessments of the present status of research, and funds development of seminal research proposals.

The Pipeline Program connects faculty and students at non-doctoral granting institutions with researchers at the University of Kentucky and the University of Louisville. Faculty-student teams commit to research at one of these institutions during two summers and maintain contact throughout the year. Students matriculate to graduate school at either UK or UofL.

The Research Start-up fund assists comprehensive universities in Kentucky by providing competitive start-up packages for new faculty hires. These packages establish support levels commensurate with those offered by academic institutions in non-EPSCoR states and assist recruiting the strongest faculty.

Research Collaboratives establish and foster large-scale R&D initiative development within Kentucky's research and education communities. Kentucky EPSCoR's success and experience facilitate establishing non-EPSCoR funded centers that develop collaborations within and between institutions, coordinate multi-institutional R&D submissions, and attract significant federal funds.

Table 10. Kentucky EPSCoR allocations of state matching funds, FY 2001-02

	<i>Actual Expenditures or Commitments</i>
NSF EPSCoR *	\$1,333,884
DOE EPSCoR	400,000
DOD EPSCoR	90,000
NASA EPSCoR	200,000
EPA EPSCoR	130,000
SBIR/STTR	9,500
Research Enhancement	62,874
Pipeline (Infrastructure)	76,342
EPSCoR Management (KSTC)	175,000
Research Incubation Grant	40,000
Total **	\$2,517,600

* NSF EPSCoR commitment is for Year-3 and only 3 months of Year-1 of Phase-4.

Total support for Year-1 of Phase-4 is \$1.5 million.

**Does not include \$4,000 lapse.

**Table 11. Kentucky EPSCoR matching grants
to public and private institutions, FY 2001-02**

UKRF	1,829,384
UofLRF	54,000
EKU	65,927
WKU	217,047
MuSU	142,500
Thomas More	13,428
KSU	20,314
Total	2,342,600

KSEF and Kentucky EPSCoR

The KBE Workgroup has been charged by the state budget office to create a plan that outlines the EPSCoR and KSEF organization, personnel, goals, activities, and proposed funding from sources other than the Commonwealth. The plan will contain performance indicators and evaluation measures for increasing funding, intellectual property, and university partnerships with other universities and businesses. A plan for Kentucky to graduate from EPSCoR also will be created.

VII. Entrepreneurial Audit

HB 572, 2000 Regular Session, assigned the KSTC an audit of Kentucky's policy framework for developing an entrepreneurial economy. The project was to provide policymakers in Kentucky with the information and research base necessary to transform its entrepreneurial policy framework into one of the most competitive in the nation.

After a national bid process, KSTC contracted with Stanford Research International of Palo Alto, California to conduct the audit. The audit specifically looked for barriers that impede technology commercialization and constraints that limit creating, growing, and recruiting innovative companies. SRI identified existing laws, regulations, and policies that brake or impede successful implementation of Kentucky's accelerator innovation initiatives. The review provided a cohesive set of policy recommendations that would overcome the constraints and barriers identified, many embodied in HB 525, 2002 amendments to the Kentucky Innovation Act.

The audit focused on three key policy areas considered indispensable in encouraging innovative growth-oriented companies: risk capital policies, taxation and location incentives, and technology commercialization policies.

The core framework for the policy audit and recommendations was technological innovation. Technological innovation is facilitated by any actions that increase the rate at which new ideas are generated, link sources of knowledge and expertise to those who need it, increase the output of research-based knowledge, and attract entrepreneurs who can put ideas, knowledge, financing, and other resources into coherent business plans that lead to successful commercialization.

The audit results are outlined on the KSTC web site (www.kstc.com).

VIII. Related Initiatives to Kentucky Knowledge-based Economy

A. Endowment Match Program (“Bucks for Brains”)

The Endowment Match Program, operationalized through the Research Challenge Trust Fund and the Regional University Excellence Trust Fund, combines public monies and extramural funding to support research at UK and UofL and to strengthen key programs at the comprehensive universities.

The total amount appropriated for the 1998-2000 biennium was \$110 million, with \$100 million to the research universities and \$10 million to the comprehensive universities. UK receives two-thirds and UofL receives one-third of the \$100 million. Funding for the comprehensive universities is based on each university's proportional share of state appropriations. The \$110 million has been leveraged with private donations to create a \$220 million research pool.

The Endowment Match Program amount appropriated for the 2000-02 biennium was \$120 million, with \$100 million to the research universities and \$20 million to the comprehensive universities. This second round of funding was distributed under the same formula as the first round, and is being leveraged to create another \$240 million research pool.

“Bucks for Brains” has increased the number of endowed chairs from 55 to 166 and endowed professorships from 53 to 228 in Kentucky's public universities as of June 30, 2002. This program also has helped the universities in their efforts to compete for federal research funds. Extramural R&D expenditures at UK and UofL have increased dramatically from \$122 million in 1997 to \$173 million in 2000. In addition, Bucks for Brains faculty have a measurable and significant positive economic impact on their communities.

UK has estimated that the employment, income, and output impacts of externally supported research lead to 7,636 jobs in Kentucky in fiscal year 2001-02. This figure includes jobs at the University and additional jobs supported throughout the state due to spending resulting from these research activities. UK also estimated that research from out of state sources contributed approximately \$138.6 million in personal income to people in Kentucky and approximately \$293.9 million in total output to the Kentucky economy.

UofL estimates the local impact of Bucks for Brains to be 1.8 times the amount of funding attracted. For every \$10 million of sponsored research at UofL, 265 jobs are created, \$16 million new annual revenue for local businesses is generated, and \$750,000 in new tax revenues are created.

B. R&D Goals

The University of Kentucky and the University of Louisville have accepted the challenge to increase federal and other extramural annual research expenditures from \$173 million in 2000 to \$500 million by 2010 and to \$1 billion by 2020. These expenditure goals have become statewide policy goals as a result of the Kentucky Innovation Commission's Strategic Plan for the New Economy. UK and UofL also have set goals to increase endowments and expenditures in the statewide research priority areas identified in the KIC plan.

UK endowments in the research priority areas are projected to increase from \$167 million in 2001 to \$222 million in 2006, and expenditures from endowments and gifts in the research priority areas will increase from \$9.4 million to \$14.3 million.

UofL endowments in the research priority areas are projected to increase from \$103 million to \$168 million and expenditures to increase from \$2.3 million will \$3.6 million.

Investments in university faculty and facilities are being targeted strategically to achieve these R&D funding goals. The type and number of resources needed have been identified and a spending blue print developed. A System Dynamic Impact Model is being used to examine the impact of increasing grant and contract funding within the priority areas and to determine how the Commonwealth can best use its leverage in building R&D capacity. When the model is complete, a business plan will delineate specific investments to be made at UK, UofL, and the comprehensive institutions.

C. Office for the New Economy Strategic Plan

HB 572, 2000 Regular Session, directed the Commissioner for the New Economy to develop a statewide strategic plan for the knowledge-based economy. Council staff assisted in drafting the plan, which was approved by the Kentucky Innovation Commission in January 2002. The plan recognizes Kentucky's current position in the knowledge-based economy, identifies niches where Kentucky might gain a competitive edge within a decade, and establishes the public policy framework necessary to achieve results. It defines goals, sets priorities, and charts a strategy already under way for success in the knowledge-based economy.

The plan includes programs housed under the council, the University of Kentucky, the University of Louisville, Kentucky Community and Technical College System, Kentucky Cabinet for Economic Development, Kentucky Department of Education, Kentucky Cabinet for Workforce Development, and the Governor's Office of Agricultural Policy.

Attachment C contains a copy of the strategic plan.

D. Innovation and Commercialization Centers

The Cabinet for Economic Development's Office for the New Economy created the Innovation and Commercialization Center program in 2001. The ICCs are public/private partnerships that assist the Commonwealth's entrepreneurs and scientists to commercialize technologies that demonstrate significant market potential.

The ICC network serves entrepreneurs who want to create technology-based companies and scientists who want to commercialize technology. The ICCs help scientists and entrepreneurs understand the start-up process and investment practices. The goals of the network are to increase quality deal flow of investments in technology-based firms in Kentucky, increase understanding of entrepreneurship, start-up processes, and investment practices, and provide value-added services to existing businesses, start-up businesses, and the investment community.

Six ICCs will bring together individuals from the business sector, universities, KCTCS, local communities, and state government to create and expand knowledge-based companies. KSTC serves as the statewide ICC headquarters and provides centralized support services. Fourteen satellite centers will serve the needs of rural areas and will be housed in KCTCS for administrative support.

E. Role Model Program

Kentucky youth must have scientist and entrepreneur role models to emulate. The Role Model Program is a partnership among UK, UofL, Eastern Kentucky University, Kentucky State University, Morehead State University, Murray State University, Northern Kentucky University, Western Kentucky University, the Governor's Office, and the Office for the New Economy. It uses university coaches and players to introduce scientists, engineers, and entrepreneurs to the public.

The Role Model Program sponsors summer internships for students to work with successful scientists, engineers, and entrepreneurs. These students learn what the scientists, engineers, and entrepreneurs do, and exposure to these professionals is expected to prompt students to broaden their perspectives and direct their aspirations to scientific and business endeavors.

The first four spotlights in the Role Model Program are Dr. Suzanne Ildstad, The Jewish Hospital Distinguished Professor of Transplantation, Professor of Surgery, and the Director of the Institute for Cellular Therapeutics at the University of Louisville; Roberto Campos-González, Ph.D., Director, Cell Signaling Research; Eugenia Wang, Ph.D., Professor of Biochemistry & Molecular Biology, University of Louisville Health Sciences Center; and, Audwin Helton, Louisville entrepreneur and developer of Spatial Data Integrations, Inc. (SDI), which provides GIS data conversion, map production and applications, and GIS services.

IX. Selected Success Stories

AgriScience

Innovation in agricultural and natural products-based research is creating groundbreaking new economic opportunities in Kentucky. At the University of Kentucky College of Agriculture, cutting-edge research is expanding high-tech agriculture industry in many areas of agricultural biotechnology, including veterinary pharmaceuticals and diagnostics, novel natural products, and plant molecular farming. The Kentucky Tobacco Research and Development Center focuses on intellectual property development and commercializing new agricultural biotechnology, particularly for plant molecular farming.

Biologistics

Location and efficiency are crucial components for meeting the global distribution needs of pharmaceutical, biotechnology, and medical device companies. Kentucky's location in the geographic center of the eastern United States, its extensive network of highway, rail, and air transportation systems, the presence of Foreign Trade Zones in Louisville and Northern Kentucky metropolitan areas, and the elimination of state, county, city, and school district property taxes on in-transit goods ensure that the unique needs of biotechnology companies are met, and that business and distribution costs are maintained at a competitive level.

To further develop this vital industry to Kentucky, the University of Louisville created the UPS Center for World Wide Supply Chain Management (UPSi), which has been engaged in conducting research, teaching, and solving problems related to supply chain management.

UofL in partnership with UPS also created the Logistics and Distribution Institute (LoDi), which is investing in logistics and urban infrastructure research and education. LoDi is facilitating interdisciplinary and application-oriented research in worldwide supply chain management, quick response services, e-logistics, transportation logistics, urban transportation, and urban infrastructure.

Information Technology

Kentucky's universities have invested in computers that provide the computational power necessary for complex bio- and medical informatics research. UofL's Speed Scientific School has recently upgraded its supercomputer installation and now ranks in the top 300. The University of Kentucky's recent acquisition of a high-performance HP Superdome supercomputer places it in the top 10 of all high-performance academic computer centers in the nation.

UK is part of the National Computational Science Alliance and serves as a supernode on the National Technology Grid, a high-speed computer network linking U.S. high-

performance computers, instrumentation, and databases. In addition, UK is part of the Partnership for Advanced Computational Infrastructure.

A new, high-capacity, fiber optic link between the two research institutions is being constructed. This link will allow collaborative research in medical applications, imagery, and supercomputer processing of genomic applications. It also will allow a direct Internet2 link to communicate with other universities at ultra-high bandwidth.

Medical Devices

Surgeons and scientists in Kentucky have been charting new advances in cardiac assist devices and transplant surgeries for over a decade. In the summer of 2001, a team of UofL cardiac surgeons successfully implanted the first totally implantable artificial heart in a Kentuckian at Jewish Hospital in Louisville. In 1999, UofL hand surgeons performed the nation's first hand transplant at Jewish Hospital.

Research continues on new medical and therapeutic devices, including microelectronic machines, devices that measure brain neurotransmitters in real-time during neurosurgery, and artificial eye prosthesis to help those who suffer from macular degeneration.

These technologies are the result of collaborative research between medical scientists and bioengineers at both the University of Kentucky and the University of Louisville. Both universities are developing strong, comprehensive bioengineering programs with capabilities for microfabrication, computer aided-design, rapid prototyping, computer visioning, medical imaging, and advanced surgical techniques.

Pharmaceuticals

Kentucky has excellent research and education in the pharmaceutical and life sciences, opportunities for drug design and pharmaceutical development, clinical trial evaluations, product commercialization, and business development.

With the third-ranked pharmacy school in the nation, the University of Kentucky leads with advances in pharmaceutical discovery. UK and UofL are uniquely positioned to produce diversified, broadly trained graduates for careers in pharmaceutical and biomedical research with two medical schools, two law schools, two engineering schools, agrisciences emphasizing research in natural products and equine genetics, and strong basic sciences programs.

X. Benefits for Kentucky Citizens

Research and commercialization are dynamic enterprises encompassing both traditional scholarship and emerging technologies. Kentucky researchers are discovering new knowledge, advancing the economic growth, and are producing results that benefit Kentuckians. Following are some examples of ongoing research at Kentucky postsecondary institutions.

- Improve learning, develop school-community partnerships, and recreate the Appalachian region's rich community education traditions by reconnecting with best practices of the past and defining thoughtful school reform;
- Use and misuse of child safety seats;
- Improve how science is taught by training Kentucky elementary and middle school teachers;
- Measure effects of the Kentucky Preschool Program on children who are considered to be at risk because of the income status of their families;
- Consult with local health departments, early childhood facilities, church nurseries, family resource centers, health professionals, and students to understand the importance of injury and injury prevention in children's lives;
- Hold summer camp to give at-risk children the life-skills necessary to deal with the temptation to try drugs;
- Encourage young women from Appalachia to pursue scientific careers in drug abuse research;
- Understand how people make decisions regarding the care of elders and how to relieve the burdens of caregiving;
- Methods to prevent farm-related deaths;
- Comprehensive screening and referral services for substance abuse, domestic violence, mental health, and learning problems that act as barriers to family safety and self-sufficiency;
- Examine outcomes and performance of state agency service providers to improve services to people with developmental disabilities;
- Design and build the world's longest plastic deck bridge, across the Levisa Fork of the Big Sandy River;

- Develop genetically improved crop plants that are disease resistant, herbicide tolerant, with improved oil and protein quality;
- Use precision agriculture to manage seed, fertilizer, pesticide, and soil and water resources using a Global Positioning Satellite System and Geographic Information Systems;
- Discover environmentally friendly ways to control agriculture pests like the Japanese beetle;
- Use biological organisms to convert common substances such as grass clippings and newspaper into a more valuable product, ethanol;
- Develop plants better able to defend themselves against microbial attack and redesign enzymes that produce plant antibiotics to generate compounds for human use;
- New treatment for equine protozoal myeloencephalitis;
- Use tobacco plants for molecular farming by introducing new genes into the tobacco to produce vaccines, medicines, and enzymes for industrial processes;
- Health research on Alzheimer's Disease, Parkinson's Disease, heart attack and stroke prevention, prostate cancer treatment, improved joint replacements, new treatments for lung cancer, and creating sensors that detect sugar levels in diabetics;
- Find a cure for paralysis caused by spinal-cord injuries;
- Treatments that help patients leave the hospital earlier or have less pain;
- Learn the relationship between intellectual performance and disrupted sleep in children;
- Identify enzymes that protect the heart from damage during a heart attack;
- Use bone marrow to fight leukemia, sickle-cell anemia, diabetes, lupus, multiple sclerosis, and AIDS, and improve tolerance for organ transplants;
- Combine chemicals to quickly create millions of compounds to determine which ones are most effective in fighting a disease or healing an injury, which control the spread of cancers and treat infectious diseases, and which prevent joint destruction caused by rheumatoid arthritis.

XI. Findings and Recommendations

Findings

- Knowledge-based economic issues were not part of the council's role defined in HB 1, but are critical to the council's role in postsecondary education and research.
- The Entrepreneurial Audit findings offer opportunities for a wide constituency to come together to plan and implement a successful economic strategy for Kentucky.
- Issues emerge as the programs are implemented and future amendments to HB 572 will be necessary.
- All knowledge-based economy programs are new and have only one year of data on which to measure success. Approximately half of the initial knowledge-based economy programs' appropriations remain to be disbursed because time was taken to set up sound program administration infrastructure, to request and thoroughly assess applications, and to disburse and manage the grants. Rigorous application and external review processes are critical to fund projects that meet high scientific and commercial standards and to develop successful research and economic initiatives for Kentuckians.
- R&D is a long-term endeavor and commercialization requires new investment funds, a deep pool of knowledgeable workers, and an entrepreneurial climate.

Recommendations

- Secure third-round funding for the Endowment Match Program and maintain the existing funding for the Commercialization Investment Programs, Innovation and Commercialization Centers, and Office for the New Economy programs [see Glossary].
- Formally establish the Knowledge-based Economy Advisory Workgroup and charge it to meet regularly to continue to guide implementation of legislation. Members should continue to include representatives from the council, the Office of the New Economy, the Cabinet for Economic Development, the Governor's Office for Policy and Management, the Legislative Research Commission, the Governor's Office on Agriculture Policy, the Finance and Administration Cabinet, EPSCoR, the Kentucky Science and Technology Corporation, and the Labor Cabinet.
- Adopt a long-term plan to "graduate" Kentucky from the federal EPSCoR program.

- Determine whether EPSCoR and the Kentucky Science and Engineering Foundation would be better served and more efficient at capturing increased federal funding if their administrations were integrated and more closely aligned.